Patent claims

1. Method for controlling an electrophotographic printer or copier (10) that has at least one developer station (20, 22, 24, 26, 28) for developing a latent charge image on a photoconductor (16) with toner,

in which the toner discharge from the developer station (20, 22, 24, 26, 28) is detected during the print operation and in which a developer regeneration process (48) is started for the case that the detected toner discharge fulfills a predetermined first regeneration criterion,

in which a charge image is generated on the photoconductor (16), the charge image is developed by the developer station and the developed image is removed by a cleaning device (32, 38) without being transfer-printed onto a recording medium (34),

and in which new toner is introduced into the developer station (20, 22, 24, 26, 28).

2. Method according to claim 1, in which the average toner discharge is determined for time intervals of predetermined length,
and in which the first regeneration criterion is fulfilled when the average toner discharge has lain below a predetermined threshold for a predetermined number of successive time intervals.

3. Method according to claim 1 or 2, in which the printer (10) or copier has a transfer belt (30) on which the developed toner image is transfer-printed from the photoconductor 16 in normal operation and from which the transfer-printed toner image is transfer-printed onto the recording medium (34).

4. Method according to claim 3, in which, in the developer regeneration process (48), the developed image is wholly or partially transfer-printed onto the

transfer belt (30) and the transfer-printed portion of the image is removed from the transfer belt (30) by a transfer belt cleaning device (38), and

in which the portion of the image that is not transfer-printed is removed from the photoconductor (16) by a photoconductor cleaning device (32).

5. Method according to claim 4, in which the developed image is transfer-printed onto the transfer belt (30) at 75% to 100% [sic] in the developer regeneration process (48).

6. Method according to any of the claims 3 through 5, in which the transfer belt (30) is moved forward of the transport path of the recording medium (34) in the developer regeneration process (48).

7. Method according to any of the preceding claims, in which whole-area patterns with an areal coverage of 10% to 50% are generated on the photoconductor in the developer regeneration process (48).

8. Method according to any of the preceding claims, in which the toner discharge is determined using print data.

9. Method according to claim 8, in which the toner discharge is determined in that the printed pixel count or the pixel count to be printed is added up, weighted with its inking level.

10. Method according to any of the preceding claims that provides a preparation mode (164) into which the printer (10) or copier is brought before the beginning of the print operation,

and in which the printer (10) or copier is brought into the preparation mode (164) at the beginning of the developer regeneration process (48).

11. Method according to claim 10, in which the preparation mode (164) comprises one or more of the following operations:

- powering up the developer station (20, 22, 24, 26, 28),
- function test of the developer station (20, 22, 24, 26, 28),
- activation of the developer,
- calibration of the operating parameters.

12. Method according to any of the preceding claims, in which the printer or copier comprises a plurality of developer stations (20, 22, 24, 26, 28) whose toner discharge is respectively detected and in which

for the case that the developer regeneration process (48) is started for one developer station (20, 22, 24, 26, 28), it is checked whether the detected toner discharge of the remaining developer stations (20, 22, 24, 26, 28) fulfills a second regeneration criterion, and

in which a developer regeneration process (48) is likewise started for developer stations (20, 22, 24, 26, 28) in which the second regeneration criterion is fulfilled.

13. Method according to claim 2 and claim 12, in which the second regeneration criterion is fulfilled when the average toner discharge has lain below a predetermined threshold for a predetermined number of successive time intervals that is less than the number in the first regeneration criterion.

14. Method for controlling an electrophotographic printer (10) or copier that has at least two developer stations (20, 22, 24, 26, 28) for developing a latent charge image on a photoconductor (16), in which

during the print operation (172) it is determined using the print data which developer stations (20, 22, 24, 26, 28) are needed for printing of the data, and

in the event that it is established that a developer station (20, 22, 24, 26, 28) was not needed or will not be needed for a predetermined time span, this developer station is shifted into a standby state in which at least one part of the mechanical actuators of the developer station (20, 22, 24, 26, 28) are stopped.

15. Method according to claim 14, in which the functional voltages of the developer station (20, 22, 24, 26, 28) are connected in the standby state such that no toner transfer can occur between the developer station (20, 22, 24, 26, 28) and the photoconductor (16).

16. Method according to claim 14 or 15, in which the developer station (20, 22, 24, 26, 28) is panned away from the photoconductor (16) in the standby state.

17. Method according to claim 16, in which the developer station (20, 22, 24, 26, 28) is panned away from the photoconductor during the standby state when the temporal duration of the standby state exceeds a predetermined threshold.

18. Method according to any of the claims 14 through 17, in which the standby state is ended when, using the print data, it is established that the developer station (20, 22, 24, 26, 28) is required for printing of the data.

19. Method according to claim 18, in which the print data are broadly, anticipatorily analyzed so that the time interval between the analysis of the print data and the point in time at which the image corresponding to these data is to be developed by the associated developer station (20, 22, 24, 26, 28) is sufficient in order to shift this developer station (20, 22, 24, 26, 28) from the standby state into the print operation state.

20. Method according to any of the claims 14 through 19 in which, during the standby state of a developer station (20, 22, 24, 26, 28), the developer contained therein is activated at predetermined intervals.

21. Method according to claim 20, in which it is determined how often or how long the developer has been activated during a standby state, and

in the event that the number of the activations or, respectively, the duration of the activation exceeds a predetermined threshold, no further activations are implemented for the duration of the standby state.

22. Method according to any of the claims 14 through 21, in which at least two printing groups (12, 14) with respectively one separate electrophotography device are provided in the printer (10) or copier, and

in which at least a portion of the components of the electrophotography device is shut down when the last developer station (20, 22, 24, 26, 28) of the printing group (12, 14) is shifted into the standby state.

23. Method according to any of the claims 1 through 13 and any of the claims 14 through 22.

24. Method according to claim 23 in which, during the standby state of a developer station (20, 22, 24, 26, 28), the developer is activated at predetermined intervals until the first regeneration criterion is fulfilled,
then no further developer activations are implemented in the developer station (20, 22, 24, 26, 28) for the remaining duration of the standby state, and with the developer regeneration process it is waited [sic] until the developer station is required for development or until another developer station of the printer or copier starts a developer regeneration process (48).

25. Method according to one of the claims 12 or 13 and claim 24 in which, for the case that the developer regeneration process (48) is started for one developer station (20, 22, 24, 26, 28), the developer regeneration processes (48) of the further developer stations (20, 22, 24, 26, 28) whose detected toner discharge fulfills the second or the first regeneration criterion are implemented in the following order:

1. Developer stations that are not found in the standby state,

2. Developer stations that are found in the standby state and that do not fulfill the first regeneration criterion, and

3. Developer stations that are found in the standby state and that fulfill the first regeneration criterion.

26. Control device for an electrophotographic printer (10) or copier that has at least one developer station (20, 22, 24, 26, 28) for developing a latent charge image on a photoconductor (16) with toner,

whereby the control device is suited to detect the toner discharge from the developer station (20, 22, 24, 26, 28) during the print operation and

to start a developer regeneration process (48) for the case that the detected toner discharge fulfills a predetermined first regeneration criterion,

in which a charge image is generated on a photoconductor (16), the charge image is detected by the developer station and the developed image is removed by a cleaning device (32, 38) without being transfer-printed onto a recording medium (34),

and in which new toner is introduced into the developer station (20, 22, 24, 26, 28).

27. Control device according to claim 26 that is suited to determine the average toner discharge for time intervals of predetermined length,

and in which the first regeneration criterion is fulfilled when the average toner discharge has lain below a predetermined threshold for a predetermined number of successive time intervals.

28. Control device according to claim 26 or 27, whereby the printer (10) or copier has a transfer belt (30) on which the developed toner image is transfer-printed from the photoconductor 16 in normal operation and from which the transfer-printed toner image is transfer-printed onto the recording medium (34).

29. Control device according to claim 28, whereby in the developer regeneration process (48) the developed image is wholly or partially transfer-printed onto the transfer belt (30) and the transfer-printed portion of the image is removed from the transfer belt (30) by a transfer belt cleaning device (38), and

whereby the portion of the image that is not transfer-printed is removed from the photoconductor (16) by a photoconductor cleaning device (32).

30. Control device according to claim 29, whereby the developed image is transfer-printed onto the transfer belt (30) at 75% to 100% [sic] in the developer regeneration process (48).

31. Control device according to any of the claims 28 through 30 that triggers that the transfer belt (30) is moved forward of the transport path of the recording medium (34) in the developer regeneration process (48).

32. Control device according to any of the claims 26 through 31 that determines the toner discharge using print data.

33. Control device according to claim 32 that determines the toner discharge in that the printed pixel count or the pixel count to be printed is added up, weighted with its inking level.

34. Control device according to any of the claims 26 through 33 that provides a preparation mode (164) into which the printer (10) or copier is brought before the beginning of the print operation,

and that brings the printer (10) or copier into the preparation mode (164) at the beginning of the developer regeneration process (48).

35. Control device according to claim 34, in which the preparation mode (164) comprises one or more of the following operations:

- powering up the developer station (20, 22, 24, 26, 28),
- function test of the developer station (20, 22, 24, 26, 28),
- activation of the developer,
- calibration of the operating parameters.

36. Control device according to any of the claims 26 through 35, whereby the printer or copier comprises a plurality of developer stations (20, 22, 24, 26, 28) whose toner discharge is respectively detected and

that, for the case that it starts the developer regeneration process (48) for one developer station (20, 22, 24, 26, 28), checks whether the detected toner discharge of the remaining developer stations (20, 22, 24, 26, 28) fulfills a second regeneration criterion, and

that likewise starts a developer regeneration process (48) for developer stations (20, 22, 24, 26, 28) in which the second regeneration criterion is fulfilled.

37. Control device according to claim 27 and claim 36, whereby the second regeneration criterion is fulfilled when the average toner discharge has lain below a predetermined threshold for a predetermined number of successive time intervals that is lower than the number given the first regeneration criterion.

38. Control device for an electrophotographic printer (10) or copier that has at least two developer stations (20, 22, 24, 26, 28) for development of a latent charge image on a photoconductor (16),

that, using the print data during the print operation (172), is suited to determine which developer stations (20, 22, 24, 26, 28) are required for printing of the data and,

in the event that it determines that a developer station (20, 22, 24, 26, 28) has not been required or will not be required for a predetermined time span, to initiate that this developer station is shifted into a standby state in which at least a portion of the mechanical actuators of the developer station (20, 22, 24, 26, 28) are [sic] stopped.

39. Control device according to claim 38, whereby in the standby state the functional voltages of the developer station (20, 22, 24, 26, 28) are connected such that no toner transfer can occur between the developer station (20, 22, 24, 26, 28) and the photoconductor (16).

40. Control device according to claim 38 or 39, whereby the developer station (20, 22, 24, 26, 28) is panned away from the photoconductor (16) in the standby state.

41. Control device according to claim 40 that triggers that the developer station (20, 22, 24, 26, 28) is panned away from the photoconductor during the standby

state when the temporal duration of the standby state exceeds a predetermined threshold.

42. Control device according to any of the claims 38 through 41 that triggers that the standby state is ended when, using the print data, it is established that the developer station (20, 22, 24, 26, 28) is required for printing of the data.

43. Control device according to claim 42 that is suited to broadly, anticipatorily analyze the print data so that the time interval between the analysis of the print data and the point in time at which the image corresponding to these data is to be developed by the associated developer station (20, 22, 24, 26, 28) is sufficient in order to shift this developer station (20, 22, 24, 26, 28) from the standby state into the print operation state.

44. Control device according to any of the claims 38 through 43 that, during the standby state of a developer station (20, 22, 24, 26, 28), triggers that the developer contained therein is activated at predetermined intervals.

45. Control device according to claim 44 that determines how often or how long the developer has been activated during a standby state and,

in the event that the number of the activations or, respectively, the duration of the activation exceeds a predetermined threshold, triggers that no further activations are implemented for the duration of the standby state.

46. Control device according to any of the claims 38 through 45, whereby at least two printing groups (12, 14) with respectively one separate electrophotography device are provided in the printer (10) or copier, and

whereby the control device triggers that at least a portion of the components of the electrophotography device is shut down when the last developer station (20, 22, 24, 26, 28) of the printing group (12, 14) is shifted into the standby state.

47. Control device according to any of the claims 26 through 37 and any of the claims 38 through 46.

48. Control device according to claim 47 that, during the standby state of a developer station (20, 22, 24, 26, 28), triggers that the developer is activated at predetermined intervals until the first regeneration criterion is fulfilled, then no further developer activations are implemented in the developer station (20, 22, 24, 26, 28) for the remaining duration of the standby state, and with the developer regeneration process it is waited [sic] until the developer station is required for development or until another developer station of the printer or copier starts a developer regeneration process (48).

49. Control device according to one of the claims 36 or 37 and claim 48 that, for the case that the developer regeneration process (48) is started for one developer station (20, 22, 24, 26, 28), triggers that the developer regeneration processes (48) of the further developer stations (20, 22, 24, 26, 28) whose detected toner discharge fulfills the second or the first regeneration criterion are implemented in the following order:

1. Developer stations that are not found in the standby state,

2. Developer stations that are found in the standby state and that do not fulfill the first regeneration criterion, and

3. Developer stations that are found in the standby state and that fulfill the first regeneration criterion.